Return to Service Manual

for

PA46 Aircraft

Meridian

PROVIDED AS A MEMBER BENEFIT FOR MMOPA

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Overview

Proper maintenance is essential to safety in aviation. As with all other high-performance aircraft, the PA46 requires close scrutiny and regular maintenance to ensure that all systems are functioning properly. At a minimum, the aircraft undergoes extensive disassembly during the annual inspection. Mid-year events or unpleasant discoveries during routine 100 hour inspections often call for substantial unscheduled maintenance between annuals. No matter the timing or cause, the first flight after extensive maintenance requires an extra dose of care and caution.

The combination of the airplane's incredible complexity and the inherent imperfections of people working on them means that maintenance itself can have the ironic effect of causing systems failures. The more extensive the maintenance, the greater is the chance for a potential problem. The primary means of identifying any issues and correcting them before one or more become catastrophic is to follow carefully an extensive and well-structured checklist.[1]

A good return-to-service post-maintenance checklist covers a comprehensive pre-flight and a structured first check-flight to prove that all systems are functioning properly. Anticipating the unforeseen, the first flight is conducted with certain precautions not routinely incorporated into normal flight operations. An example is staying close to the airport, which of course is not practical for cross-country flying but essential to the safety of an initial check-flight.

Background and History

In 1991 the first edition of our MMOPA magazine included the first of several installments on preparing the plane for return to service after a major maintenance event.
The five part series was written by Andrew Cindric, a former Piper Director of the Aircraft Completion Center in Vero Beach.

His series was converted into booklet form and distributed to all members for easy use with the plane at the point of service. Andrew's introduction is still applicable today:

> *Return-to-Service Test Flight*
>
> *Is it really necessary? Is it a legal requirement? Why should I do it? Who should do it? How long does it take?*
>
> *We will take a look at the answers to these questions and many more in the following discussion. I personally believe a Return-to-Service Test Fight should be performed any time engine or control surface repairs and adjustments were made, an aircraft is coming out of an annual or 100 hour inspection, after major maintenance was performed, etc.*

[1] The pilot-in-command is responsible for the safe and proper operation of his/her aircraft and it is the responsibility of the pilot-in-command to operate that aircraft in compliance with that aircraft's Pilot's Operating Handbook and other official manuals and directives.

Legally, it depends on how the mechanic or inspector interprets the regulations. One shop may indicate a test flight is necessary, another may say don't worry about it. "Why should the answer to this be any different than most other rules regarding aviation?"

The reason a test flight should be performed is to prove that everything is operating the way it was intended to operate. If it initially doesn't, then you can find the problem during a test flight where you the pilot and maybe an assistant are the only ones aboard the aircraft. Some of the discrepancies 1 have come across over the years on the first flight after maintenance, I sure would not have wanted to encounter on a dark, rainy night with the weather near minimums.

Andrew's narrative style manual is no longer in print but the original articles are viewable on the MMOPA web site.

With the addition of new PA46 models, engines and techniques it seems reasonable to update this valuable manual for all members. The Board of Directors commissioned this update by asking instructors and a mechanic experienced in each model to write a Return to Service manual specific to a model and in a format that can easily be used in the plane. Because of the wide variety of avionics and aftermarket products, only the standard systems usually found in the PA46 will are covered.

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General Principles

The time to discover a problem resulting from a significant maintenance event and repairs or modifications is before carrying passengers or in hard instrument conditions.
The Test Flight should be performed after the following events:

- Annual Inspection to prove airplane airworthiness and systems function.
- Extensive airframe repairs or alterations to prove basic airworthiness.
- Extensive engine repairs or alterations (such as engine replacement) to prove proper functioning.
- When airplane has not been flown for an extended period of time.
- Extensive avionics alterations or upgrades to prove proper functioning and interfaces with the autopilot, and to prove other systems have not been affected.

And potentially:

- Prior to annual inspection in order to fine-tune the squawk list.
- Prior to purchase.

Common sense dictates that no matter what airplane is being flown, certain essentials must be addressed prior to the first post-maintenance check-flight.

Review and discuss with the mechanic all the maintenance that was completed, and use that as an initial guide to focus early attention for the first flight.

- Pay attention to any parts that were replaced in addition to normal checklist items.
- Consider taking a good look under the cowling and any access panels before taking the aircraft out of the shop.
- Test as many systems as possible on the ground before lifting off. Test the autopilot, but also get a good feel of the plane by hand-flying a portion of the test flight.
- This is a good time to check infrequently-used or rarely-tested systems like emergency gear extension, stall warning and anti-icing, for example.
- Fly multiple approaches to test avionics in multiple scenarios, and to ensure the integrity of the navigation equipment at the most critical moments of a flight.

Following major maintenance, the aircraft preflight inspection should take about one hour. Do not rush through this process. As has been found whether air-racing or just completing a normal flight, the event is usually "won" on the ground and lost in the air. Invest the necessary time up-front to have a safe and uneventful return to service. Use the Piper Event Checklists to help conduct the inspection in an organized fashion so that nothing is missed. These checklists are available from any Piper dealer. Some items on the checklists require tools, but remember this is a pilot inspection, not an annual inspection: do not use tools on the expanded walk-around except for a bright flashlight, notebook and pen. Document all items and functions that do not reflect a normal condition.

Position the aircraft to an area suitable to a comfortable inspection, with the expectation of lying prone on the ground for some time to look into the wheel wells and nose gear bay. If inexperienced, bring along someone with the proper experience to help. The most common problems and issues are highlighted here, but everything must be checked for normal condition and function. Perform the preflight inspection per POH procedures.

If the airframe and/or engine have undergone extensive repairs or alterations, it would be desirable to perform the preflight with a knowledgeable representative of the shop that performed the work. The same is true for extensive avionics work or upgrades. A knowledgeable representative of the shop that performed the work should go through an avionics cockpit check, explain any installation-unique features and review all the interfaces with the autopilot. Note that due to previously-installed avionics many of these avionics alterations or upgrades have features that are unique to the airplane being tested. These features have to be clearly understood by the test pilot before an effective Test Flight can be conducted.

A responsible and knowledgeable representative of the shop that performed the work must also be ready and willing to ride along on the Test Flight, if so requested by the test pilot. This is a non-negotiable condition and should be made clear to the shop before any work is performed. If the shop refuses to agree to these terms, find another shop.

Pilot Qualifications

The pilot performing the Test Flight has to be well qualified in the operation of the airplane and all of its systems. A low-time pilot, or a pilot just qualified in the airplane, should not be performing the Test Flight (no time-builders allowed) without a competent instructor on board. No passengers allowed. No flight training should be conducted during the Test Flight. At the most, a qualified assistant (such as a mechanic or avionics technician) can be carried. If you do not feel qualified to perform the Test Flight, seek assistance.

A test pilot should be prepared for the unexpected and, equally important, should have confidence in his own abilities to deal with emergencies. The test pilot should also be inquisitive as to what was done to the airplane, and by whom. Trust, but verify. Remember, reasonable paranoia is a good attribute for a test pilot.

Equipment on Board

The equipment to be carried is sometimes determined by the nature of the systems to be checked, for example a propeller strobe to measure accurate RPM. Sometimes no specialized equipment needs to be carried for the Test Flight. However, the following basic equipment, at a minimum, should be carried at all times:

- A note pad and a pen (to write down any discrepancies during the Test Flight).
- A pocket multi-tool such as a Leatherman®, or equivalent, but always remember you are not a mechanic.
- A portable VHF transceiver (with a charged battery).
- A Halon (1211 or 1211-1301 blend) fire extinguisher.

Flight Area and Environmental Conditions

Conduct the Test Flight in good day VFR only, and remain close to the airport, straying no more than 50 NM. Make no exception to this rule. An airport equipped with good emergency services (firefighting and first aid) would be highly desirable. Also, depending on the importance of the items being checked (i.e. basic airworthiness of the airframe and engine), it would be desirable to remain closer (within 10 NM or within easy gliding distance) of the departing airport.

Safety

While obvious, safety must be the number one priority of any Test Flight. The test pilot should never be rushed or under pressure to complete the flight. If any condition arises that puts the safe outcome of the Test Flight in doubt, the flight must be terminated immediately. Be prepared to declare an emergency even if suspecting the conditions require such action.

Checklist Structure

Each model of the PA46 has a unique configuration based on engine type and year of production. Reflecting that diversity, there are several versions of this manual. Each devoted to one model:

the Meridian, JetProp, Mirage/Matrix or Malibu. The Matrix is combined with the Mirage, with the expectation that Matrix pilots will simply ignore any checklist items relating to pressurization. Each member will receive the section applicable to his/her model. The return-to-service checklist for each variation of the PA46 is unique, even if much of the checklist is common to all.

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THE PILOT IN COMMAND IS RESPONSIBLE FOR THE SAFE AND PROPER OPERATION OF HIS/HER AIRCRAFT AND IT IS THE RESPONSIBILITY OF THE PILOT IN COMMAND TO OPERATE THAT AIRCRAFT IN COMPLIANCE WITH THAT AIRCRAFT'S PILOT'S OPERATING HANDBOOK AND OTHER OFFICIAL MANUALS AND DIRECTIVES.

ANNOTATED CHECKLIST

Preflight

Aircraft and Maintenance Documents

- Review with the shop each maintenance item completed and verify the return to service endorsement prior to any operation.

- Aircraft Inspector (IA) signs off in the maintenance logs.

  Maintenance logs must be reviewed for completion of work. Several insurance companies have denied claims because the aircraft was not properly returned to service with appropriate entries entered into the maintenance log books and properly authenticated by an IA.

- Verify that all Airworthiness Directives (AD) are complied with. Service letters and service bulletins may or may not be optional per the FAA, but the manufacturer considers them all to be mandatory. Discuss this with your AI.

- Verify the revision level of the POH.

  Call any Piper Service Center Parts Department. The representative will need the "VB" number in the lower right corner of the page, and the serial number of the aircraft. At the time of this writing, Piper will provide up to 3 revision levels free of charge. If the book is 4 or more revisions out of date, a new book will need to be purchased. To ensure the timeliest response, contact Piper in writing and inform Piper the request comes from the aircraft owner. Note that the FAA database on ownership transfers can lag 90 days or more.

- Verify that the current weight and balance data sheet is in the POH and that the POH is in the aircraft prior to any operation.

- Verify that airworthiness certificate and Registration are displayed on the aft bulkhead in the aircraft.

- Check for complete and correct placards on the aircraft using the up-to-date POH.

  A list of required placards is found in Section 2, "Limitations."

- Check weather and file flight plan for a local flight, if the early preflight to this point has not precluded continuing with the flight.

  The test flight should be done in VFR conditions or conditions providing adequate weather should unanticipated equipment failures be experienced. If the test flight is conducted to satisfy a regulatory requirement, passengers are not allowed. A

knowledgeable second person can be helpful during portions of the checkout when the pilot's attention needs to be focused on flying the aircraft.

Initial Observations

- Observe the general condition of the aircraft as you approach. Verify the struts are level and that nothing is hanging, dripping, or inappropriately attached, unattached or missing.

- Check fuel visually and note level. Secure the caps.

- Verify that the correct tires are installed. The main tires are size 600x6, 8 ply and the nose is 500x5, 8 ply.

- Check tire pressure with a pressure gauge.

  Use a gauge with the correct pressure range. Bring a small right-angle Phillips screw driver to remove the main wheel fairings that cover the valve stems. Main tires should be inflated to 55 lbs.; nose tires to 70 lbs.

  Verify the airplane has been washed after the maintenance was complete.

Initial Cockpit and Interior Check

- Gear selector down.

- Check windows for cracks and security.

- Check that all switches are in proper position and that all breakers are in.

- Check elevator is free and correct.

  Check for free and correct movement with full travel of control wheel. The elevator should deflect trailing-edge up when the control wheel is moved aft, and trailing-edge down when the control wheel is moved forward.

  Pull control wheel full aft to the stop and verify that it moves full forward under the force of the spring when released.

- Check ailerons are free and correct.

  Check for free and correct movement with full travel of control wheel. Left turn: left aileron up; right turn: right aileron up. Check ailerons neutral with control wheel level.

- Verify that all electrical switches and radio master are off.

Main Cabin Door (MCD) and Fuselage

- Check main cabin door pressure seal.

  The main cabin door (MCD) should be checked for pressure seal abrasions and punctures, particularly at the door locking pin wells. Sometimes the pin damage even extends to the fuselage skin in front of the pin wells. While this is indeed ugly, paint damage does not affect performance.

- Inspect the fuselage below and aft of the MCD for skin and paint damage from baggage transfer.

  The top half of the MCD may be misaligned at the seam between the door and fuselage, tight on the forward side and wide on the aft. This is typical on older aircraft. The condition may result from operating the engine on the ground with the top half of the door open without selecting 0 degrees propeller pitch with beta. If this occurs and the door is dropped to the jamb, paint chipping at the forward seam of the MCD will result.

- Visually inspect the cable for broken strands and/or loose hardware. Check the cables for even tension fore and aft.

  Proper and equal tension will ensure that even weight is applied when the steps are used. The cable stays on the Meridian MCD are fragile and need special attention during operation. Under no circumstances should any untrained person be allowed to operate this door except in an emergency.

- Inspect the hinge of the lower half of the MCD for evidence of corrosion.

  This hinge area is exposed to a lot of water. Almost any airplane three years older or more will experience some corrosion here.

- Check the condition of the aircraft belly for excessive oil (if airplane has not been washed).

  Oil on the belly is a problem for two reasons. Oil is in a place in which it is not designed to be, and this oil is not where it should be. In addition to engine and cosmetic issues, excessive belly oil can peel off condensate drain decals, render antennas inoperative (particularly the twin blade traffic alert antenna) and lead to yaw damper amplifiers malfunctioning. Some of these problems can be quite expensive to fix. Belly oil can result from multiple causes and each will have to be considered until the source is found.

- Check all surfaces for loose rivets.

  Commonly referred to as “working” or “smoking” rivets, loose rivets on the aft fuselage bulkheads cause damage to skin and bulkhead flanges. While any loose rivet should be addressed, two rivet lines in particular require special attention: the diagonal line on both sides running from the belly to the tail cone, and the aft most line running from left to right at the tail cone. Both are safety of flight issues and should be corrected immediately.

- Check for damage to the tail tie-down ring.

  With heavy passengers and a light fuel load the aircraft can pivot on the main tires and strike the ground with the tail tie-down ring. If the ring is damaged, *do not fly the aircraft* until a qualified mechanic has repaired the damaged and signed off the airplane. Load the front right seat passenger first to avoid any possibility of a tail strike.

Elevator

- Check elevator function and integrity.

  Lift the elevator smoothly from the center rivet line. Listen and feel for signs of binding. A misaligned pitch trim capstan retainer can cause a faint, but noticeable scraping sound when the elevator is exercised, and could cause damage to the capstan. The anti-servo trim tab should defect trailing edge up when the elevator is pushed down and trailing edge down when elevator is pushed up.

Right Wing

- Check carefully the dielectric paint (the flat black paint that borders the boot).

  This area is often abraded from ice and rain. If this paint is damaged or missing, the ability of the static charge to find its way to the wicks is reduced, leading to potential ice boot damage from pinholes. If boots develop pinholes, the ejector pump sucks in rain water that corrodes the sequence valves which, in turn, causes the boots to fail. It would also be wise to request a continuity check of the static wicks before leaving the shop if the shop is so equipped.

- Check boot integrity.

  Ice boots improperly maintained lead to reduced functionality and/or failure. If the boots are not kept properly coated, the surface becomes dull and has a propensity to hold ice.

- Check for missing static wicks and/or vortex generators.

  Missing wicks are not airworthiness issues on the Meridian but they are important for reasons already mentioned. (FAA feels that missing wicks can affect flight control balance. I've seen planes grounded at ramp checks for missing wicks) While missing static wicks are not limited in the POH, six or more missing vortex generators (VGs) exceed the POH limitation and render the Meridian un-airworthy. In addition to the main wing, be sure to check the VGs on the underside of the horizontal stabilizer.

- Verify that the two stall strips on each wing, located mid-wing and near the wing root, are present and secured.

- Lower the flaps and listen and check for smooth operation. Check the cable and pulley alignment in the recess for abnormal conditions.

  Look for aftermarket chafe tape on the top of the flap surface. This tape will protect the small corners of the aft wing surface and prevent paint abrasion on the top of the flap in these areas. This is a small item, but important in the long run.

- Check all exterior lights (position, strobe, navigation, landing, taxi, pulse and ice).

- Check for a leaking or obstructed main fuel tank vent.

  These are the "one way" NACA vents, one under each outer wing segment. If fuel is leaking from this vent the problem needs to be addressed.

  Note that the small cylindrical vent in the cap is a two way vent. It is not unusual for fuel to leak here if the tank was filled and left in a warm environment. Older style plastic vent caps have a tendency to get brittle from fuel contamination and break off.

- Check the fiberglass radome for cracks and chips.

  If the paint on the radome is chipped, flying in the rain will cause water to wick into the exposed fiberglass fabric. This contamination will cause gross errors in the display. In this case, the radome will probably need to be replaced. Avoid storing anything other than clean rags in the small storage area in the aft portion of the radome. The factory delivers new aircraft with the red plugs and cuffs neatly folded and placed carefully in the radar pod storage area, but pilots doing the same generally do much pushing and pulling, perhaps causing the long cracks often seen in the paint on the radar pod. An aftermarket clear cover for the front of the radome will help prevent chips in the paint. This should be considered a must-have item.

- Check the right main strut/wheel/tire/brake assembly.

This assembly should be checked thoroughly for cleanliness and the absence of any evidence of hydraulic leaks or fuel leaks in the well. The shiny surfaces of the strut and actuator are sealing surfaces. They should be conspicuously clean to avoid abrading the seals. Use non-petroleum based cleaner on these about every 30 days.

- Check the strut and doors for hardware and hinge security and alignment.

- Check the brake pad thickness.

  Brake pad minimum thickness is 0.10" or about the thickness of two stacked pennies. The inner and outer pads should be evenly worn, and the disc should be free of ridges. If not, the caliper may not be floating properly, which can lead to brake overheating and reduced takeoff performance. If the pads appear to be uneven or excessively worn, have them evaluated by an authorized mechanic.

- Remove the Pitot cover if the aircraft is so equipped and verify the condition of the Pitot tube.

- Verify that the fuel cap is secure.

- Look for any loose screws on the access panels particularly at the forward edge of the inboard wing section.

Engine Cowling and Nose Section

- Ensure that all of the cowling fasteners are present and flush with the cowling.

  Tapping on the seams can reveal a loose fastener if one or more is suspect.

- Verify that the intake plugs, exhaust covers and propeller cuffs are removed and properly stowed.

  Consider a gym bag to hold these items so that your interior does not become contaminated with turbine exhaust residue. Do not stow these items in the radar pod because cracking of the painted surfaces can result from flexing of the housing.

- Inspect the propeller blades for nicks and grease leaks.

- Place your foot on the top of the nose wheel tire and try to push the tire rearward. There should be no play in the strut.

  If the strut makes a "thunk-thunk" sound, have it addressed before flying.

- Verify that the physical turn stops on the nose wheel trunnion are not damaged.

If the flange is cracked or bent, or if the stop is wiped off, the trunnion is damaged and should be repaired or replaced before flight.

- Look carefully at the nose wheel and stem valve.

  The brass valve stem should be on the right hand side. The valve should not be bent over near or against the wheel. If so, the stem is damaged and could fail, causing a flat tire. This sort of damage is most commonly caused by a tow bar coming loose during towing. Bending the stem back can fatigue the metal to the breaking point, so have the tube replaced.

- Look at the wheel on the right side. Verify that the castellated nut that holds the wheel in place has a clevis pin in place, and that the flat head and retaining hardware are in place.

  The nut is torqued with only enough force to center the wheel bearing. If the pin comes out, the nut can easily fall off.

- Look up into the nose wheel bay. Give special attention to the sequencing valve, hydraulic hoses of the landing gear system and lower portion of the nose wheel actuator.

  All of these places can have minor leaks that evidence themselves with small amounts of dry hydraulic fluid near the source of the leak. If the leak is bad enough, fluid on the left hand side of the tire may be flung outward toward the tread by the centrifugal force of the landing rollout. Note that the tire lies in the wheel well with the left side up.

- Check the level of engine oil at the site gauge on the left side of the engine.

  Oil should be visible in the glass column but no higher than the first rivet up in the green. Only fill with one third quart at a time to prevent overfilling and "oily belly syndrome." Storage bottles are available for unused oil remaining in the can.

Left Wing

- Repeat inspection as with Right Wing. Inspect but do not touch the stall warning vane. It is sensitive and prone to damage and it has its own test button on the panel.

- Close the bottom half of the main cabin door during fueling operations. Always supervise fueling.

  If the left tank is over-filled, fuel will run toward the aft inner segment of the wing and find its way to the flap track. From here, a light breeze can cause fuel to drip on

the cabin entry steps. When the door is closed, the jet fuel smell will permeate the cabin until the steps are disassembled and thoroughly cleaned.

- Test the stall warning vane and heater for proper operation. DO NOT TOUCH OR MOVE THE VANE.

  Vane function: have someone inside the aircraft turn on the Battery Master Switch and press the stall warning test button while you observe the vane. The vane should move full deflection when the test button is pushed.

  Vane heating: When the Meridian comes from the factory its stall vane heater is wired through the left main gear door switch. However, after compliance with Piper AD 2008-26-11, which requires installation of the stall warning heat control modification kit, the high stall heat will instead be activated by actuation of the squat switch. If AD 2008-26-11 has been accomplished, test stall heat on the ground using the following procedure. With the stall heat switch in the cabin "on", have someone actuate the squat switch, located on the left main gear scissor. Have a second person feel the mounting base of the stall transducer. It should get hot almost immediately, after which the squat switch should be released. Do not touch the stall transducer tab.

- Confirm proper function of the door ajar light on the annunciator panel.

  While the battery master switch is on and the MCD is open, observe the presence of the door ajar light on the annunciator panel. Close and latch the lower half of the MCD and verify that the door ajar light remains on. Close and lock the upper half, and confirm the light extinguishes.

Baggage Storage Area

- Look carefully at the sight gauge in the aft baggage bulkhead for proper hydraulic fluid level. Have a mechanic add fluid (MIL-H-5606) if necessary.

- Check all of the seat backs for integrity and cracks beneath the carpeted backs.

  This type of damage is quite common, especially in cold weather. The problem is caused by kneeling on the forward folded seat while loading bags or putting too much weight high on the seatback when entering or exiting the cockpit.

- Verify that the spring loaded seat back release latches are operating normally and not damaged or binding.

- Check seat belts for fraying and integrity.

Passenger Seating Area

- Check each passenger seat recliner for correct operation.
- Operate all of the arm rests to ensure that they operate correctly and do not sag.
- Check the reading lights and the courtesy lights for proper operation.
- Check the emergency exit as you would on a preflight for security and proper placarding.
- Check all headset jacks for proper operation.
- Open the oxygen drawer under the starboard middle seat, and verify that the masks are correctly stowed and ready for operation.

    The carpet and carpet cover or rug should not interfere with the drawer operation.

- Verify that each fresh air vent works correctly, and verify a flow of air through the lower plenum with the vent/defog blower in operation.
- Check the folding table for tightness and smooth operation.

    Tables can be broken from flailing in rough air.

- Operate the window shades.

    Many operators use these shades for sun protection on the ramp. This causes the pleats to take a “set” and the shades will then crumble when they are raised abruptly. Instead, use the Kennon shields to preserve the shades.

Pilot and Copilot Storage Areas

- Verify that the drawers slide and latch correctly.
- Verify that the oxygen bottle service drawer latch and the post lamp on top of the cabinet near the gauge are in tact and working correctly.

    These items are commonly broken from mismanagement.

- Check the oxygen tank gauge to verify that the tank is full.
- Turn on the O_2 and operate the mask.

Take the mask out of the compartment and test it. Make sure all of the features are working, including the rotary "emergency" O_2 free-flow switch on the bottom. Ensure that the mask seal is not deformed and is sealing correctly. Most pilots never take out the mask, which can be damaged from being stored incorrectly for extended periods. Look carefully at the seals on the mask and the dowel and latches on the door. These are sometimes broken from hurried or improper attempts to replace the mask. Note the level of O_2 and then check the level again post flight to verify that the connectors are not leaking. They often do leak. If unsure how to replace the mask, leave that task for the maintenance crew or other qualified personnel. A component can easily break when trying to ad lib on replacing the mask.

- Check the fire extinguisher.

  The dual Halon extinguisher should have a placard or sticker certifying the weight. A pull pin should be in the charge handle and it should be stowed properly in the drawer beneath the O2 mask.

- Close and latch the door.

  Ensure that the door halves do not bind and that all of the indicator windows operate properly.

Pilot and Copilot Seats

- Check all functions just as with the passenger seats.

- Check seats for positive engagement of seat latch, and for installed stops at each seat track.

- Check the height adjustment, the fore/aft slide adjustment and lumbar support function.

- Verify proper seat belt function.

  Make sure that the seat belts on all seats are installed correctly and not bound by the seat track or seat position.

  Check lap belts and shoulder harnesses for fraying. Check shoulder harnesses for proper operation of inertia reels (should lock when tugged).

FIRST TEST FLIGHT

Before Engine Start

- Check the security and function of each and every switch, left to right around the cockpit.

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- Turn the night lights up and verify that all lights and dimmer knobs are working, particularly the standby instrument internal lights and the rocker switches. Subdued lighting will be required, so consider performing this portion of the test in a hanger or at night.

- Press the fire detect test and verify the annunciator light.

- Test the stall warning system.

- Press the annunciator panel test button and observe that all of the lights are working.

- Verify the primary static air source is selected.

- Observe that the gear selector is in the down position.

- Fuel Shut off valve open (T-handle stowed and covered).

- Check windows for cracks and security, particularly the older style pilot side window with the triangular DV window in it.

- Check that all switches are in proper position and that all breakers are in.

- Check elevator is free and correct.

  Check for free and correct movement with full travel of control wheel. The elevator should deflect trailing edge up when the control wheel is moved aft, and down when moved forward. Pull control wheel aft to the stop and verify that it moves full forward under the force of the spring when released.

  Move elevator trim wheel manually through its full travel up and down to verify indicator accuracy and no binding.

- Check Ailerons are free and correct.

  Check for free and correct movement with full travel of control wheel. Left turn: left aileron up; right turn: right aileron up. Check that both control wheels line up with each other. Check that fixed trim tab on right aileron is reasonably faired-in

with top surface of aileron. An excessively bent tab suggests an out-of-rig condition. Do not attempt to adjust this tab yourself as it is very easy to mis-rig the aircraft or damage the control surface.

- Check the power quadrant

  Verify that it is at idle flight – do not exercise it because it contains a woven wire control segment which is easily kinked from movement when the engine is not running.

  Verify that the MOR is in the detent and that the condition lever is in the cut-off/feather position.

- Verify that all electrical switches, autopilot master and radio master are off.

Engine Start

Under normal conditions, using a 28V GPU is recommended whenever one is available. However, for the test flight, the battery condition must be verified, so initiate a battery start.

- Use normal start procedures per the POH.

- Note and record engine start parameters.

  During engine start, pay careful attention to oil pressure, ITT, bus voltage, amperage, NG as well as the rates of recovery of these items. Results will vary but these items should be within usual limits as specified in the POH and from prior experience.

After Engine Start

- Conduct the post-start checklist per the POH, and note any discrepancies.

- Verify proper operation of heating and air conditioning.

- Verify all data subscriptions are up to date and that all avionics boot up correctly.

- Copy and set the clearance into the panel in the usual way.

  Note any discrepancies as data are entered. An IFR clearance will be needed for the portion of the checks done above 17,500 feet, but that does not mean flying in IMC. Fly in VMC on the first flight test; some low altitude checks require VMC. To avoid delays, take off VFR and pickup the IFR clearance at a filed time, altitude and fix (a VFR/IFR flight plan).

- Note Hobbs time, local time and fuel on board.

Taxi

- Verify braking action on all four pedals (if a co-pilot is on board).
- Check for play in the rudder steering mechanism. There should be none. Check the copilot side as well.
- Conduct a beta lockout test.
- Check the flight control systems for free and correct operation. Include the autopilot in this check.

  Follow the procedure for the autopilot check in the POH.

- Note the free and correct movement of all of the instruments including the compass. Verify the presence and correctness of the compass card.
- Check the ELT.

  Plan to run the ELT for a few cycles while monitoring 121.5, but only during the first 5 minutes after the hour.

- Press and hold each Pitot-Static System Condensate Drain for a second or two, and observe that there are no "nervous" pitot static instruments. Do not open these drains during pressurized flight or damage to the instruments may result.
- Conduct an over-speed governor check at the run-up area.
- Verify COM and NAV frequencies are set properly.

Take-Off /Climb

- Use normal callouts for the take-off roll and initial climb.
- Note engine instrumentation on take-off roll and during climb and record them once the autopilot is engaged.
- Note the length of the take-off roll.

The Meridian should be at 2/3 of the rotate speed in approximately 900 feet or less on a standard sea level day. If not, check for dragging brakes, un-commanded roll-back on the power lever or instrument error.

- Observe gear cycle time and verify normal operation.

  Normal cycle time is 7 seconds. Throughout the flight, verify that the gear pump light does not cycle excessively. Use the autopilot for all operations except take-off and landing and stall series to ensure that the autopilot is working in all flight regimes.

- Check flight controls.

  Verify normal and proper response during climb.

- Verify power is 150 ft-lbs below red line.

Low Altitude

- Verify engine parameters are operating in normal range.

- Verify correct operation of the Cabin Pressurization System. At or below 7,000 feet MSL:

  Conduct a cabin dump (use a cabin pressure of about 2.5 PSI).

  Dump cabin with the electrical dump switch and manual dump lever. Safety valve should open immediately when electrical dump switch is pressed.

  Restore the cabin to normal pressure.

  If not already done, set the cabin at least 3,000 ft below current altitude and allow the cabin pressure to stabilize.

  Set the rate controller fully clockwise to expedite this.

  Turn the Environmental Control System (ECS) Knob to High and note normal operation.

  Turn the ECS Knob to Emergency and note normal operation.

  Return the ECS Knob to Normal.

  Verify the cabin pressure system is operating as commanded.

- Set up for VMC cruise flight between 8,000 and 10,000 AGL if possible; verify all pilot and copilot instrumentation are in agreement and within limits.

- Check wing balance and airplane rigging.

  Fuel should be precisely balanced and the rudder trim centered. Verify that the ball is centered in the turn and bank indicator. At cruise airspeeds disconnect autopilot, if employed, and release control wheel. If aircraft rolls left or right, it is wing heavy. Note how many seconds it takes to make a 20 degree change in bank angle and provide this information to the mechanic. Adjustment of the ground adjustable tab on the right aileron can improve this condition but it is a bit of a hit and miss proposition and may take more than one attempt. Do not attempt to make this adjustment yourself.

- Check flap operations and rigging.

  Trim the airplane for level flight below full-flaps extension speed and set rudder trim for zero yaw.

  While maintaining speed, cycle flaps through each position (10, 20, 36 degrees and then UP) while visually verifying the flaps position and agreement with the flap handle position.

  With landing gear retracted, verify that the gear warning horn sounds and the gear warning light illuminates when the flaps position is 20 degrees or greater.

  While maintaining 100 KIAS in level flight with flaps fully deflected (36 degrees), release ailerons and time any roll to a 20-degree angle of bank. The aircraft should not roll off beyond 20 degrees within approximately 10 seconds.

- Activate the alternate static system and verify correct operation per the POH.

- Operate and verify correct operation of all threat ID equipment on board: NEXRAD, RADAR, lightning detection/sferics, terrain awareness, ground proximity warning, TAS, and TIS.

- Check Fuel Pumps, Igniters and Ice Protection for correct operation.

  Look for proper annunciation and electrical load. Observe aircraft limits, but be sure to check the auto functions as well.

- Press the Stall Warning Test Button, and verify the presence of the horn and that the autopilot disconnects.

- Set the torque to 200 lbs, and verify the presence of the ignition light on the annunciator panel and the gear warning horn.

- Press the gear warning horn silence button. Return the torque to 350 lbs, and verify that the horn silencer has reset and that the Ignition Light extinguishes.

- Verify the correct operation of the autopilot CWS.

- Verify the correct operation of the Go Around (TOGA) button (Magic 1500 autopilots only).

- Test the Emergency Gear Extension system per the POH.

- Confirm proper airspeed indications.

  Check airspeed indications against aerodynamic stalls in dirty and clean configurations. Airspeed indicator should not have more than 5% error when encountering the stalls.

- Engage the autopilot and confirm the settings on the altitude pre-select and autopilot annunciator panel.

  Check all modes (refer to POH/Pilot's Guide for procedures of specific autopilot installed in airplane). Confirm heading and navigation modes for tracking. Allow the aircraft to level off at a predetermined altitude and ensure that the autopilot captures the altitude smoothly and accurately. If adjustments are required, note if the up/down trim selector allows precise changes to the altitude mode on the autopilot. Use the Control Wheel Steering (CWS) function on the control wheel and adjust the altitude 100 ft or more, and note if the autopilot hold reflect the new altitude.

- Perform imminent stalls to verify that the stall horn works correctly in dirty and clean configurations.

  Perform a power-off, wings-level full stall (beyond the aerodynamic buffet) with flaps up and with flaps full down. When approaching the full stall, the rate of airspeed reduction should be 1 knot/second or less. The airplane must be controllable before, during, and in the recovery phase of the stall. If you are unfamiliar or uncomfortable with these tests, fly with a qualified instructor.

- Test all avionics.

  Check all modes, (refer to POH/Pilot's Guide for procedures of specific avionics equipment installed in airplane).

  For each Com radio and each Nav radio, check the squelch and volume control. Perform a radio check in flight.

Check the proper functioning of the Audio Selector Panel.

- Communicate with ATC and ensure transponder altitude matches aircraft's.

- Maneuver aircraft in a variety of turns and climbs to ensure control surface responses.

High Altitude and Cruise

- Climb to FL 280 if possible, and verify the "cabin above 10,000 ft" light.

- Verify that the cabin pressurization system is producing 5.5 PSI when commanded by the altitude controller.

- Set engine power for max cruise in accordance with the POH, and verify engine parameters and performance.

Arrival

- Execute a coupled ILS and GPS WAAS (if so equipped) approach to verify proper interface/coupling with the installed autopilot.

Landings

- Aircraft should track straight ahead on the runway when the trims are correctly configured. Beta and reverse should be checked for normal operation prior to slowing below 40 knots.

Post Flight

- Check the exterior of the aircraft for evidence of leaks.

  Check the fluid level of the hydraulic pump inside the cabin.
  Once outside of the cabin, walk around the airplane and pay careful attention to check for any leaks (fuel, oil, hydraulic fluid) and check:

  - Engine oil level.
  - Left hand side of the nose wheel tire.
  - Actuators and struts.
  - Nose wheel bay.
  - Belly and the tail tie-down ring.

After using the air conditioner, it is normal for water to drain from the evaporators drain (short pipe) below the aft fuselage.

All discrepancies noted during the flight should be submitted to the maintenance chief. If the aircraft is going to be returned to service immediately upon the conclusion of the test flight, the log books should have a statement noting that the aircraft meets all appropriate maintenance FARs and procedures and found acceptable to be returned to service.

ACTION CHECKLIST

Preflight

Aircraft and Maintenance Documents

- ☐ Review with the shop each maintenance item completed and verify the return to service endorsement prior to any operation.
- ☐ Aircraft Inspector (IA) signs off in the maintenance logs.
- ☐ Verify that all Airworthiness Directives (AD) are complied with.
- ☐ Verify the revision level of the POH.
- ☐ Verify that the current weight and balance data sheet is in the POH and that the POH is in the aircraft prior to any operation.
- ☐ Verify that airworthiness certificate and Registration are displayed on the aft bulkhead in the aircraft.
- ☐ Check for complete and correct placards on the aircraft using the up-to-date POH.
- ☐ Check weather and file flight plan for a local flight, if the early preflight to this point has not precluded continuing with the flight.

Initial Observations

- ☐ Observe the general condition of the aircraft as you approach. Verify the struts are level and that nothing is hanging, dripping, or inappropriately attached, unattached or missing.
- ☐ Check fuel visually and note level. Secure the caps.
- ☐ Verify that the correct tires are installed. The main tires are size 600x6, 8 ply and the nose is 500x5, 8 ply.
- ☐ Check tire pressure with a pressure gauge.

Initial Cockpit and Interior Check

- ☐ Gear selector down.
- ☐ Check windows for cracks and security.
- ☐ Check that all switches are in proper position and that all breakers are in.
- ☐ Check elevator is free and correct.
- ☐ Check ailerons are free and correct.
- ☐ Verify that all electrical switches and radio master are off.

Main Cabin Door (MCD) and Fuselage

- ☐ Check main cabin door pressure seal.
- ☐ Inspect the fuselage below and aft of the MCD for skin and paint damage from baggage transfer.
- ☐ Visually inspect the cable for broken strands and/or loose hardware. Check the cables for even tension fore and aft.
- ☐ Inspect the hinge of the lower half of the MCD for evidence of corrosion.
- ☐ Check the condition of the aircraft belly for excessive oil (if airplane has not been washed).
- ☐ Check all surfaces for loose rivets.
- ☐ Check for damage to the tail tie-down ring.

Elevator

- ☐ Check elevator function and integrity.

Right Wing

- ☐ Check carefully the dielectric paint (the flat black paint that borders the boot).
- ☐ Check boot integrity.
- ☐ Check for missing static wicks and/or vortex generators.
- ☐ Verify that the two stall strips on each wing, located mid-wing and near the wing root, are present and secured.
- ☐ Lower the flaps and listen and check for smooth operation. Check the cable and pulley alignment in the recess for abnormal conditions.
- ☐ Check all exterior lights (position, strobe, navigation, landing, taxi, pulse and ice).
- ☐ Check for a leaking or obstructed main fuel tank vent.
- ☐ Check the fiberglass radome for cracks and chips.
- ☐ Check the right main strut/wheel/tire/brake assembly.
- ☐ Check the strut and doors for hardware and hinge security and alignment.
- ☐ Check the brake pad thickness.
- ☐ Remove the Pitot cover if the aircraft is so equipped and verify the condition of the Pitot tube.
- ☐ Verify that the fuel cap is secure.
- ☐ Look for any loose screws on the access panels at the forward edge of the inboard wing section.

Engine Cowling and Nose Section

- ☐ Ensure that all of the cowling fasteners are present and flush with the cowling.
- ☐ Verify that the intake plugs, exhaust covers and propeller cuffs are removed and properly stowed.

- ☐ Inspect the propeller blades for nicks and grease leaks.
- ☐ Place your foot on the top of the nose wheel tire and try to push the tire rearward. There should be no play in the strut.
- ☐ Verify that the physical turn stops on the nose wheel trunnion are not damaged.
- ☐ Look carefully at the nose wheel and stem valve.
- ☐ Look at the wheel on the right side. Verify that the castellated nut that holds the wheel in place has a clevis pin in place, and that the flat head and retaining hardware are in place.
- ☐ Look up into the nose wheel bay. Give special attention to the sequencing valve, hydraulic hoses of the landing gear system and lower portion of the nose wheel actuator.
- ☐ Check the level of engine oil at the site gauge on the left side of the engine.

Left Wing

- ☐ Repeat inspection as with Right Wing.
- ☐ Close the bottom half of the main cabin door during fueling operations. Always supervise fueling.
- ☐ Test the stall warning vane and heater for proper operation. DO NOT TOUCH OR MOVE THE VANE.
- ☐ Confirm proper function of the door ajar light on the annunciator panel.

Baggage Storage Area

- ☐ Look carefully at the sight gauge in the aft baggage bulkhead for proper hydraulic fluid level. Have a mechanic add fluid (MIL-H-5606) if necessary.
- ☐ Check all of the seat backs for integrity and cracks beneath the carpeted backs.

- ☐ Verify that the spring loaded seat back release latches are operating normally and not damaged or binding.

- ☐ Check seat belts for fraying and integrity.

Passenger Seating Area

- ☐ Check each passenger seat recliner for correct operation.

- ☐ Operate all of the arm rests to ensure that they operate correctly and do not sag.

- ☐ Check the reading lights and the courtesy lights for proper operation.

- ☐ Check the emergency exit for security and proper placarding.

- ☐ Check all headset jacks for proper operation.

- ☐ Open the oxygen drawer under the starboard middle seat, and verify that the masks are correctly stowed and ready for operation.

- ☐ Verify that each fresh air vent works correctly, and verify a flow of air through the lower plenum with the vent/defog blower in operation.

- ☐ Check the folding table for tightness and smooth operation.

- ☐ Operate the window shades.

Pilot and Copilot Storage Areas

- ☐ Verify that the drawers slide and latch correctly.

- ☐ Verify that the oxygen bottle service drawer latch and the post lamp on top of the cabinet near the gauge are in tact and working correctly.

- ☐ Check the oxygen tank gauge to verify that the tank is full.

- ☐ Turn on the O2 and operate the mask.

- ☐ Check the fire extinguisher.

- ☐ Close and latch the door.

Pilot and Copilot Seats

- ☐ Check all functions just as with the passenger seats.
- ☐ Check seats for positive engagement of seat latch, and for installed stops at each seat track.
- ☐ Check the height adjustment, the fore/aft slide adjustment and lumbar support function.
- ☐ Verify proper seat belt function.

FIRST TEST FLIGHT

Before Engine Start

- ☐ Check the security and function of each and every switch, left to right around the cockpit.

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- ☐ Turn the night lights up and verify that all lights and dimmer knobs are working, particularly the standby instrument internal lights and rocker switches.
- ☐ Press the fire detect test and verify the annunciator light.
- ☐ Test the stall warning system.
- ☐ Press the annunciator panel test button and observe all of the lights.
- ☐ Verify the primary static air source is selected.
- ☐ Observe that the gear selector is in the down position.
- ☐ Fuel Shut off valve open (T-handle stowed and covered).
- ☐ Check windows for cracks and security.
- ☐ Check that all switches are in proper position and that all breakers are in.
- ☐ Check elevator is free and correct.
- ☐ Check Ailerons are free and correct.
- ☐ Check the power quadrant, flight idle, MOR in detent and condition lever in cutoff/feather.
- ☐ Verify that all electrical switches and radio master are off.

Engine Start

- ☐ Use normal battery start procedures per the POH.

- ☐ Note and record engine start parameters.

After Engine Start

- ☐ Conduct the post-start checklist per the POH, and note any discrepancies.
- ☐ Verify proper operation of heating and air conditioning.
- ☐ Verify all data subscriptions are up to date and that all avionics boot up correctly.
- ☐ Copy and set the clearance into the panel in the usual way.
- ☐ Note Hobbs time, local time and fuel on board.

Taxi

- ☐ Verify braking action on all four pedals (if a co-pilot is on board).
- ☐ Check for play in the rudder steering mechanism. There should be none. Check the copilot side as well.
- ☐ Conduct a beta lockout test.
- ☐ Check the flight control systems for free and correct operation. Include the autopilot in this check.
- ☐ Note the free and correct movement of all of the instruments including the compass. Verify the presence and correctness of the compass card.
- ☐ Check the ELT.
- ☐ Press and hold each Pitot-Static System Condensate Drain for a second or two, and observe that there are no “nervous” pitot static instruments.
- ☐ Conduct an over-speed governor check at the run-up area.
- ☐ Verify COM and NAV frequencies are set properly.

Take-Off /Climb

- ☐ Use normal callouts for the take-off roll and initial climb.
- ☐ Note engine instrumentation on take-off roll and during climb and record them once the autopilot is engaged.
- ☐ Note the length of the take-off roll.
- ☐ Observe gear cycle time and verify normal operation.
- ☐ Check flight controls.
- ☐ Verify power is 150 ft-lbs below red line.

Low Altitude

- ☐ Verify engine parameters are operating in normal range.
- ☐ Verify correct operation of the Cabin Pressurization System at or below 7,000 feet MSL.
- ☐ Set up for VMC cruise flight between 8,000 and 10,000 AGL if possible; verify all pilot and copilot instrumentation are in agreement and within limits.
- ☐ Check wing balance and airplane rigging.
- ☐ Check flap operations and rigging.
- ☐ Activate the alternate static system and verify correct operation per the POH.
- ☐ Operate and verify correct operation of all threat ID equipment on board: NEXRAD, RADAR, lightning detection/sferics, terrain awareness, ground proximity warning, TAS, and TIS.
- ☐ Check Fuel Pumps, Igniters and Ice Protection for correct operation.
- ☐ Press the Stall Warning Test Button, and verify the presence of the horn and that the autopilot disconnects.

- ☐ Set the torque to 200 lbs, and verify the presence of the ignition light on the annunciator panel and the gear warning horn.
- ☐ Press the gear warning horn silence button. Return the torque to 350 lbs, and verify that the horn silencer has reset and that the Ignition Light extinguishes.
- ☐ Verify the correct operation of the autopilot CWS.
- ☐ Verify the correct operation of the Go Around (TOGA) button (Magic 1500 autopilots only).
- ☐ Test the Emergency Gear Extension system per the POH.
- ☐ Confirm proper airspeed indications.
- ☐ Engage the autopilot and confirm the settings on the altitude pre-select and autopilot annunciator panel.
- ☐ Perform imminent stalls to verify that the stall horn works correctly in dirty and clean configurations.
- ☐ Test all avionics.
- ☐ Communicate with ATC and ensure transponder altitude matches aircraft's.
- ☐ Maneuver aircraft in a variety of turns and climbs to ensure control surface responses.

High Altitude and Cruise

- ☐ Climb to FL 280 if possible, and verify the "cabin above 10,000 ft" light.
- ☐ Verify that the cabin pressurization system is producing 5.5 PSI when commanded by the altitude controller.
- ☐ Set engine power for max cruise in accordance with the POH, and verify engine parameters and performance.

Arrival

- ☐ Execute a coupled ILS and GPS WAAS (if so equipped) approach to verify proper interface/coupling with the installed autopilot.

Landings

- ☐ Aircraft should track straight ahead on the runway when the trims are correctly configured. Beta and reverse should be checked for normal operation prior to slowing below 40 knots. Verify that the proper Ng is evident at this time.

Post Flight

- ☐ Check the exterior of the aircraft for evidence of leaks.

- ☐ All discrepancies noted during the flight should be submitted to the maintenance chief.

NOTES